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ABSTRACT

This study investigated the effectiveness of finger mathematics with elementary pupils in second grade. The sample consisted of 56 pupils located in a lower socioeconomic area of Chicago. Half the pupils were taught using the finger method; the other half experienced the traditional textbook paper-and-pencil method. The results indicated that finger mathematics significantly improved the mathematics achievement of second graders at all ability levels. It is felt that additional research, particularly longitudinal studies, need to be conducted to assess the finger mathematics program with all elementary school children. (MP)

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AN EXPERIMENTAL STUDY OF SENSORY(FINGER)MATH

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Learning the four basic mathematical processes of addition, subtraction, multiplication and division is being changed by the introduction of finger mathematics in the American curriculum. Finger mathematics known initially as Chisanbop, was introduced in the United States by a Korean citizen Hang Young Pai in 1976 (4). Chisanbop in Korean means Chi=finger, San=calculation, and Bop=method (finger calculation method). Since then Lieberthal (2) developed a slightly different version call "Fingermath", and Chavez (1) developed "Sensory Math."

Basically, finger calculation is a finger manipulative method of performing the four basic operations with whole numbers executed by ten fingers. The right hand represents the units place, the left hand the tens place, and by means of a systematic sequence of finger positions one can count to 99. For numbers above 99, the sequence is repeated. Finger calculation is not a panacea or replacement for the regular mathematics curriculum. It is an introductory, reinforcement and supplemental technique for learning the basic processes.

Finger calculation has become increasingly popular and effective where it has been used with children in the United States. For example, finger calculation is not only compatible with children learning style, but it has been shown that young children using it can solve addition, subtraction, multiplication and division

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problems faster than an adult using an electronic calculator (5).

Although research studies on finger mathematics are limited, those completed have shown positive results. A study done in 1978 in Waterford, Michigan (3) showed second graders obtained significantly higher computation scores than the control group. Similar results were obtained in the Riverside School District in 1979 in which first graders using finger mathematics had a 1.9 grade level gain in one year (3).

In 1980 the Texas Education Agency (7) found a significant (.05) gain in overall mathematics achievement for first and second graders using finger mathematics. And fifth graders showed significantly (.05) higher mathematics sentence scores than the traditional math group. Gurau and Lieberthal (2), who used finger math system with both normal and handicapped children, found it "helpful as well as enjoyable for the children (p. viii)." Since finger mathematics appears to becoming a popular method of instruction and there are only a few studies that have examined its effectiveness, additional research was needed.

Sample and Method

To test the effectiveness of finger mathematics with elementary school children, the writers conducted a study in a Chicago Public School with fifty-six second graders. The school is located in a lower socioeconomic community. The sample was selected and placed in the experimental and control groups on a random basis. Twenty-nine second graders (exp. group) were taught the finger mathematics method, and the 29 control group pupils used the traditional

textbook and paper and pencil method. Each group was taught 60 minutes per day. The duration of the study was eight months--1979-1980. The Iowa Test of Basic Skills was administered at the completion of the study(8). A 3-way analysis of variance was used to determine the effect of gender and ability grouping on the significance of the findings (.05 level).

Results

The findings showed a significant (.02-.05) difference in math concept, problem solving and composite achievement scores in favor of the finger math group (see Table I).

Three way analysis of variance showed no significant effect or interaction of gender on the dependent variable-- achievement scores. However, analysis indicated a major influence of ability grouping on the findings. Both the high and average achievers obtained significantly higher (.05) number concept, problem solving and composite scores than their lower achieving peers (see Table II), but their was no significant difference in the mean scores of the high and average achievers on any of the three dependent variables and the control group. There were equal sample sizes of the three ability groups in the experimental and control groups.

The criteria for ability group placement is based on the Chicago Public School's curriculum mastery learning, called Continuous Development Program in which individualized instruction and evaluation are employed. Teachers continually evaluate the children and basic skills learned are recorded on individual and class

progress cards. Children who are achieving at the third grade level or higher are classified as high achievers. Those working at grade level are average achievers, and children achieving below grade level are low achievers.

Discussion

The findings indicate that finger math significantly improves the mathematics achievement of second graders. The results of this study support the findings of the Waterford, Michigan (3), Riverside School District (3) and the Texas Education Agency (7) studies in which significant gains for finger math students were found. Extraneous factors that may have influenced the results of this study were the Hawthorne effect in that the experimental group was involved in a novel program, i.e., using fingers for calculation. They appeared to be more motivated and interested than the control group. Parental involvement was more evident with the experimental group than the control group regarding the uniqueness of the program and the progress of their children. Since the experimental group received both traditional math with the finger math program, the change in pace of activities could have been a stimulating factor.

The traditional math program involved teacher directed learning, demonstration of problems on the blackboard, textbook and ditto sheet exercises, including homework assignments. The students in both the experimental and control groups had one and a half hours of instruction per day.

The experimental group spent thirty minutes of this period on finger math.

The findings suggest that all ability group levels benefited from the finger math method. Finger math appears to be a viable technique to teaching the four basic processes to children. Psychologically it appears to be compatible with children's learning style. It may provide the natural transition between motor activity and cognitive development. Steiner (6) supports this idea, "If the child has to do actions with his own body which need to be thought out first, this will develop thinking in the proper way. Learning will be facilitated and retention increased (p. 25)." This has some logic in that becoming proficient in a skill rests in the forgetting of the learning process. For example, we acquired the ability to write because we have forgotten the process which has sunken into the subconscious. Also learning appears to be facilitated when a multisensory approach is employed. Finger math involves fine motor activity, oral recitation, sensory involvement (learning, seeing and touch), and cognition.

Other factors are involved in teaching finger math skills. The school principal and teachers must accept the program. Teachers may feel threatened by having to learn the psychomotor skills involved in finger math. Higher grade level teachers may feel uncomfortable about receiving an entire or a partial class of second and third graders who are proficient in the four basic arithmetical processes. Teacher aides would probably be needed to help supervise proper fingering and positioning and individualized instruction.

Like any new innovation that involves the learning of new skills it will meet slow acceptance in the schools. Intensive inservice workshops and teacher education method courses in finger math may facilitate its implementation into the schools. In any case, additional research, particularly longitudinal studies, need to be conducted to assess the finger math program with all elementary school children.

Table I - Summary of F Values for the Finger Math and Traditional Math Groups

IOWA TEST	Experimental *** (N=27)**		Control (N=29)		F Probability (DF=56)
	Mean	S.D.	Mean	S.D.	
Number Concept	2.61*	.52	2.30	.45	.02
Problem Solving	2.34*	.50	2.01	.44	.05
Composite Scores	2.46*	.52	2.19	.44	.03

**Two students had transferred from the school

Table II - Summary of F Values of Composite Scores for High, Average and Low achieving Finger Math and Traditional Groups**

	High Achievers N=20		Average Achievers N=27		Low Achievers N=9	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Number Concept	266*	.47	249*	.40	186	.47
Problem Solving	241*	.48	224*	.36	171	.57
Composite Score	253*	.47	235*	.34	178	.51

*.05 level

**There were sample sizes, 10 each of high achievers, 13 and 14 average achievers and 5 and 4 low achievers in the experimental and control groups, respectively.

*** Two (2) students tranfered from the school during the study,

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8. IOWA TEST BASIC SKILLS are designed to provide information on the status of pupil development in the basic skill areas. The norms appear to be truly representative of the general population -- grade equivalents, age equivalents and standard scores. Measures general intellectual skills and abilities. ITBS content is clearly specified, representative of curriculae goals in the U.S. ITBS has high reliability coefficients for split half (.97-.98) and equivalent forms (.96-.97). The reviewers state ITBShas been carefully developed and thoroughly researched.